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NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON
NATIONAL DAM SAFETY PROGRAM. ROCKAFELLOWS MILLS DAM (NJ00568).

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RARITAN RIVER BASIN
SOUTH BRANCH RARITAN RIVER
HUNTERDON COUNTY
NEW JERSEY

ROCKAFELLOWS
MILLS DAM
NJ00568

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM



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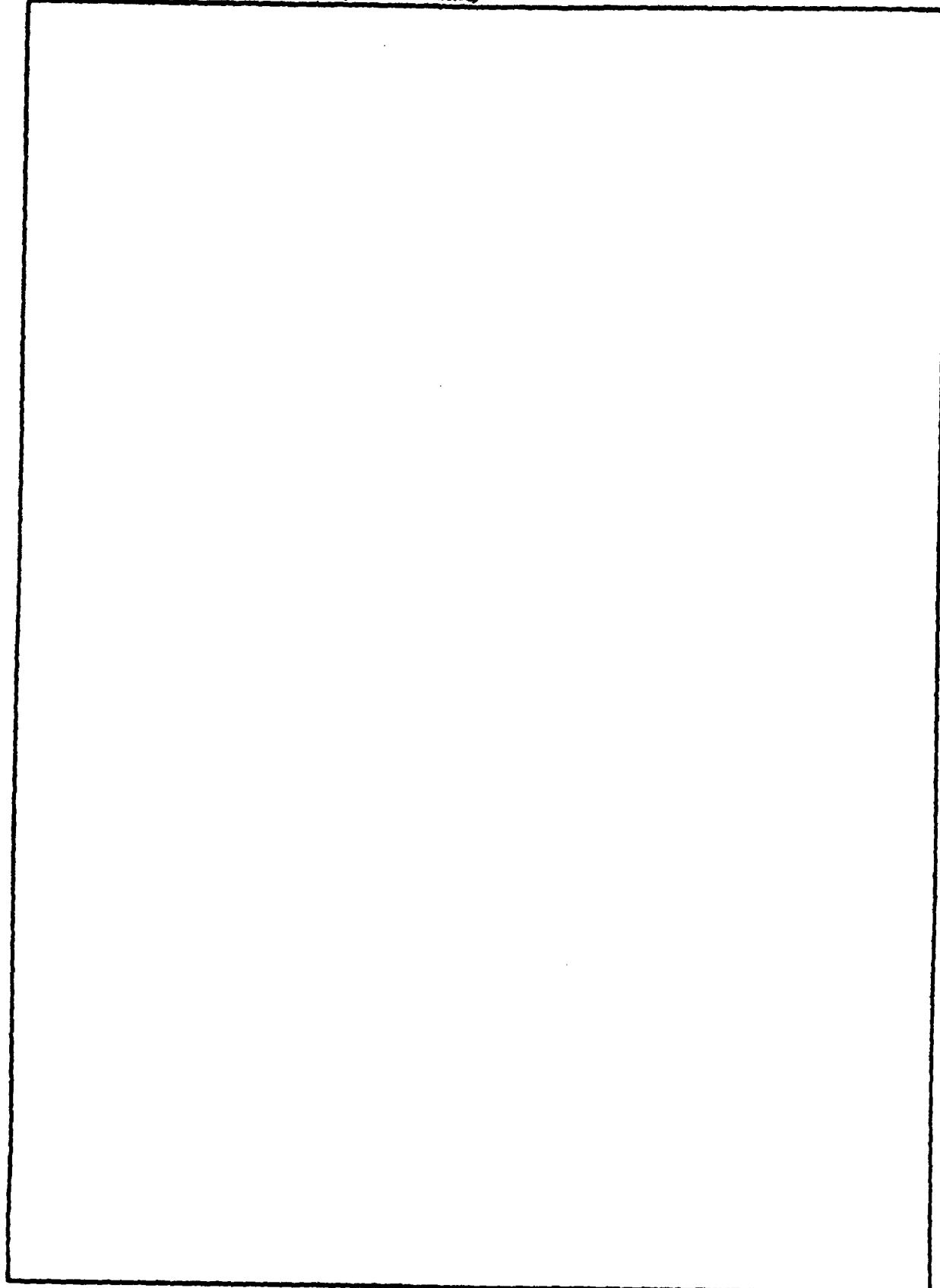
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.		

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6 National Dam Safety Program.
ROCKAFELLOWS MILLS DAM
(NJ00568)

Raritan River Basin, South Branch Raritan
River, Hunterdon County, New Jersey.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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IN REPLY REFER TO

RAPEN-N

21 JUL 1981

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Enclosed is the Phase I Inspection Report for Rockafellows Mill Dam in Hunterdon County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Rockafellows Mills Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. However, the spillways are considered inadequate, as 5 percent of the 100 year design flood would cause the dam to be overtopped. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reasons no further studies or increase of spillway capacity are recommended. However, to assure the continued functioning of the dam and its impoundment the following remedial actions will be undertaken by the owner:

- a. Repair all spalled and deteriorated concrete on the downstream face of the spillways within twelve months.
- b. Repair the cracked and deteriorated left wingwall within twelve months.
- c. Fill in the eroded area of the bank at the left wingwall with suitable material within twelve months.

A copy of the report is being furnished to Mr. Dirk C. Holman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Courter of the Thirteenth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

NAPEN-N

Honorable Brendan T. Byrne

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,



ROGER L. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

1 incl
As stated

Copies furnished:

Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Regulation
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

ROCKAFELLOWS MILLS DAM (NJ00006)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 17 March 1981 by HARRIS-EGG Associates, under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 91-636.

Rockafellos Mills Dam, initially listed as a high hazard potential structure but reduced to a low hazard potential structure as a result of this inspection, is judged to be in fair overall condition. However, the spillways are considered inadequate, as 2 percent of the 100-year design flood would cause the dam to be overtopped. The low hazard potential classification means that in the event of failure of the dam, no loss of life and only minimal economic loss is expected. For the same reasons no further studies or increase of spillway capacity are recommended. However, to assure the continued functioning of the dam and its impoundment, the following remedial actions could be undertaken by the owner:

- a. Repair all spalled and deteriorated concrete on the downstream face of the spillways within twelve months.
- b. Repair the cracked and deteriorated left wingwall within twelve months.
- c. Fill in the eroded area of the bank at the left wingwall with suitable material within twelve months.

APPROVED:


ROGER T. BALDWIN
Lieutenant Colonel, Corps of Engineers
Commander and District Engineer

DATE:

27 July 81

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name: Rockafellows Mills Dam, I.D. NJ 00562
State Located: New Jersey
County Located: Hunterdon County
Stream: South Branch Raritan River
River Basin: Raritan River Basin
Date of Inspection: March 27, 1981

Assessment of General Conditions

Rockafellows Mills Dam is a concrete dam spanning the South Branch of the Raritan River. The concrete overflow spillway is connected to an undershot water wheel structure at the right end. The overall condition of the dam is fair. There are no major signs of distress or instability in the dam. The low-level outlet valves supplying water to the wheel, as well as the wheel, are no longer operable. Two of the valves are shut and the other two are opened slightly. The hazard potential is recommended to be downgraded to "low".

Rockafellows Mills Dam is considered inadequate in view of its lack of spillway capacity to pass the SDF(100-year storm) without overtopping the dam. The spillway is capable of passing a flood equal to 4 percent of the SDF (100-year storm) and is assessed as "inadequate".

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory. The following actions are recommended along with a timetable for their completion. All recommended actions should be conducted under the supervision of an Engineer who is experienced in the design, construction and inspection of dams.

1. Repair all spalled and deteriorated concrete on the downstream face of the spillways within twelve months.
2. Repair the cracked and deteriorated left wingwall within twelve months.
3. Fill in the eroded area of bank at the left wingwall with suitable material within twelve months.



John F. Talerico, P.E.
HARRIS-ECI ASSOCIATES



Photo taken on March 27, 1981

R O C K A F E L L O W S M I L L S D A M

View looking towards right end of dam.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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ASSESSMENT OF GENERAL CONDITIONS

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

ROCKAFELLOWS MILLS DAM, I.D. NJ 00568

SECTION 1

1. PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn, is contracted to the Philadelphia District of the Corps of Engineers, and was carried out by the engineering firm of Harris-ECI Associates of Woodbridge, New Jersey.

b. Purpose of Inspection

The visual inspection of Rockafellows Mills Dam was made on March 27, 1981. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Rockafellows Mills Dam is a rock fill concrete gravity dam with an overall length of 290 feet and a maximum height of 14 feet. The dam is comprised of three sections; a 235 foot long broad crested weir main spillway; a 20 foot long concrete wall at the right end of the main spillway acting as an auxiliary spillway; and a 35 foot long low-level outlet structure at the right end of the dam. The crest of auxiliary spillway is 1.8 feet higher than the main spillway. The section of the low-level outlet structure which

contains a 8 foot by 10 foot undershot water wheel, is a 10 foot by 15 foot concrete structure and has a crest four feet higher than the main spillway.

At the left end of the dam is a concrete capped rock filled L shaped wingwall. The portion of the wall parallel to the river is approximately 40 feet long with an average width of 5.5 feet with a top elevation 1.2 feet above the crest of the spillway. The other portion of the wingwall is approximately 15 feet long and 5 feet wide with a top elevation approximately 9 inches above the spillway. The left bank of the river has an elevation approximately two feet above the spillway and is part of a wide flood plain at approximately the same elevation.

The flow to the water wheel is through four 20-inch pipes. The water wheel is no longer in use as the valves that control the flow through the pipes are no longer operable.

The flow from the spillway discharges into the natural river channels that flows under Rockafellows Mill Road through a 10 foot by 300 foot opening approximately 300 feet downstream. From there the flow continues eastward passing under U.S. Route 202 approximately 2,400 feet downstream of the spillway. The flow from the outlet structure discharges into a deep narrow channel that flows under Rockafellows Mill Road through a 40-inch by 65-inch corrugated metal pipe approximately 300 feet from the dam and then continues downstream approximately 400 feet more before joining the river.

A generalized description of soil conditions is contained in Report No. 6, Hunterdon County, Engineering Soil Survey of New Jersey, by Rutgers University. The report dated 1952 describes this river area soil as recent alluvium, composed of non-residual material deposited by and still subject to alluvial action. The underlying formation is shale with minor occurrence of interbedded sandstone and its depth below the surface varies considerably. Geologic Overlay Sheet 24 describes the underlying rock as Brunswick Formation.

b. Location

Rockafellows Mills Dam is located on the south branch of the Raritan River in the Township of Raritan, Hunterdon County, New Jersey. It is accessible from U.S. Route 202 via River Road and Rockafellows Mill Road.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineers, the dam is classified in the dam size category as being "small", since its storage volume of 50 acre-feet is less than 1,000 acre feet. The dam is also classified as "small" because its height of 14 feet is less than 40 feet. The overall size classification of Rockafellows Mills Dam is "small".

d. Hazard Classification

A hazard potential classification of "low" has been assigned to the dam. This is based on the facts that the main use of the downstream area is agriculture and pasture lands and the three residential structures immediately downstream are above the flood plain. Therefore a hypothetical failure would not result in excessive property damage and no loss of life can be expected in the event of dam failure.

e. Ownership

Rockafellows Mills Dam is owned by:

Mr. Jacob Beitz
R.D. 7 Box 679
Flemington, NJ
(201) 782-8196

f. Purpose

Rockafellows Mills Dam is presently used to impound water for industrial and recreational purposes. The impounded water is used by the Tenneco Chemical Company, located approximately 3,000 feet upstream from the dam.

g. Design - Construction History

The original construction date for Rockafellows Mills Dam is unknown. The dam was rebuilt in 1919 to supply power for a mill located at the right edge of the dam. In 1930 and 1978 dam failures were recorded. The cause and extent of the failure in 1930 or resulting damage is unknown. In 1978, there was a 30 foot breach at the right end of the main spillway. According to the owner, the downstream area did not sustain any damage from the breach.

h. Normal Operating Procedures

The discharge from the dam is unregulated and allowed to naturally balance the inflow from the river.

1.3 Pertinent Data

a. Drainage Area

174.0 sq. mi.

b. Discharge at Dam Site

Ungated spillway capacity at elevation of top of dam: 1,707 cfs (99.8 NGVD)

Total spillway capacity at maximum pool elevation (SDF): 40,769 cfs (106.21 NGVD)

c. Elevation (Feet above NGVD)

Top of dam: 102.0

Maximum pool design surcharge (SDF): 106.21

Recreation pool: 98.0

Spillway crest: Main: 98.0
Auxiliary: 99.8*

Streambed at centerline of dam: 88.0 (Estimated)

Maximum tailwater: 90.0 (Estimated)

d. Reservoir

Length of maximum pool: 3,500 ft. (Estimated)

Length of recreation pool: 2,500 ft. (Estimated)

e. Storage (acre-feet)

Spillway Crest: 27

Top of dam: 50 @ 99.8 NGVD* (Estimated)

Maximum pool (SDF): 275

f. Reservoir Surface (acres)

Top of dam: 13 @ 99.8 NGVD* (Estimated)

Maximum pool (SDF): 105 (Estimated)

Recreation pool: 8.2

Spillway crest: 8.2 (98.0 NGVD)

* Elevation at which river overflows left bank onto a wide flood plain.

g. Dam

Type:	Concrete gravity dam with rock fill core.
Length:	290 ft.
Height:	14 ft.
Top width:	1.5 ft.
Side slopes - Upstream:	Unknown
- Downstream:	Nearly vertical
Zoning:	Unknown
Impervious core:	Unknown
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

i. Spillway

Type:	Broad crested weir
Length of weir:	Main: 235 ft. Auxiliary: 20 ft.
Crest elevation:	Main: 98.0 NGVD Auxiliary: 99.8 NGVD
Gates:	None
U/S Channel:	South Branch Raritan River
D/S Channel:	South Branch Raritan River

j. Regulating Outlets

Low level outlet:	4 - 20-inch pipes
Controls:	Gate valves
Emergency gate:	None
Outlet:	Unknown

SECTION 2

2. ENGINEERING DATA

2.1 Design

There are no drawings or design computations for Rockafellows Mills Dam available. No data from soil borings, soil tests or other geotechnical data is available. The only information relating to the dam is a copy of a reference data sheet on file at the Trenton offices of the NJ Department of Environmental Protection (NJ-DEP).

2.2 Construction

Data is not available concerning the as-built construction of the dam. No data exists on the construction methods, borrow sources, or other data pertinent to the construction of the dam.

2.3 Operation

Formal operation records are not kept for the dam. The overflow from the dam is unregulated and the river is allowed to operate naturally.

2.4 Evaluation

a. Availability

The availability of engineering data is very poor. The stated information concerning the dam is available from the NJ-DEP.

b. Adequacy

The engineering data available together with that obtained in the field, was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform a stability analysis, but preliminary evaluation could be made based on visual observations.

c. Validity

Information contained on a reference data sheet and checked by limited field measurements appears to be valid.

SECTION 3

3. VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection of Rockafellows Mills Dam revealed the dam and spillway to be in fair condition and in need of repairs. At the time of the inspection the river level was above the crest of the spillway.

b. Dam

The dam is relatively sound and the vertical and horizontal alignments appeared good. The downstream face of the dam is very badly spalled and there is a diagonal crack about 60 feet to the right of the left end, which appeared tight at the time of inspection. A 30 foot section at the right end of the dam was breached and repaired in 1978. The horizontal joint between the old dam and the repaired section is open about one inch. Also the downstream side of the repaired section of the dam has been undermined.

c. Appurtenant Structures

1. Spillway

The spillway is a broad crested concrete overflow weir running the entire length of the dam. (See above).

2. Wingalls

There is a wingwall at the left end of the dam. It is L shaped consisting of a paved concrete cap underlain by rock fill. The concrete cap is badly cracked and settled. The upstream face has been completely eroded exposing the rock fill. The left side of the wingwall, which is parallel to the river, has been eroded and deteriorated due to seepage. A large section of the bank to the left of this wingwall has also been eroded from seepage. The seepage which was evident under the entire length of this wingwall, flows around the short end of the L section into the downstream channel.

3. Outlet Works

The outlet works located at the right end of the dam, consist of four 20-inch pipes and the undershot water wheel. Two of the control valves are closed and the remaining two are partially opened. None of the valves for the four pipes are operational, therefore they can not be opened or closed. The outlet structure has some cracked and spalled concrete on the top surface.

d. Reservoir Area

The banks of the river are about 2 feet high and very flat. The left bank is pasture land with some trees, River Road parallels the right bank. Sedimentation was noticed along the river bottom and at the top of the spillway.

e. Downstream Channel

The downstream channel is very wide and rocky with a small island in the middle of the channel. The banks are shallow and flat with pasture land on the left and flat lightly wooded land on the right. The channel crosses under Rockafellows Mill Road 300 feet downstream from the dam and then under Route 202 approximately 2,400 feet downstream from the dam. Three residential structures are located on the left and above the flood plain just downstream of Rockafellows Mill Road.

SECTION 4

4. OPERATION PROCEDURES

4.1 Procedures

Rockafellows Mills Dam is used to impound water for recreational purposes as well as to supply water to the Tenneco Chemical Co. located approximately 3,000 feet upstream from the dam. The level of the impounded water is maintained through the unregulated flow over the spillway.

4.2 Maintenance of the Dam

There is no regular inspection and maintenance program for the dam. The owner is responsible for the maintenance of the dam.

4.3 Maintenance of Operating Facilities

The low-level outlets consist of four 20-inch pipes that provide water to the undershot water wheel. None of the valves for any of the pipes are operational so the outlets can not be opened or closed. Two of the valves are closed and the other two are partially opened.

4.4 Evaluation

The present operational and maintenance procedures are fair with the dam and spillway being maintained in a serviceable condition.

SECTION 5

5. HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Rockafellows Mills Dam is approximately 174 square miles. A drainage map of the watershed of the dam site is presented on Plate 1, Appendix D.

The topography within the basin is generally moderately sloped. Elevations range from approximately 1,200 feet above NGVD at the northwest end of the watershed to about 100 feet at the dam site. Land use patterns within the watershed are mostly undeveloped and wooded with some residential development around the upstream lake areas.

The evaluation of the hydraulic and hydrologic features of the dam was based on criteria set forth in the Corps guidelines and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the Dam is the 100-year storm.

The 100-year Flood was calculated from 100-year precipitation using National Weather Service Hydro-35 and Technical Paper No. 40. A three hour unit hydrograph, supplied by the Corps of Engineers, for Darts Mill Dam (NJ 00788) (D.A. 165 square miles), was used with adjustment for the larger drainage area (174 square miles).

Initial and constant infiltration loss rates were applied to the 100-year rainfall to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the 100-year flood hydrograph utilizing program HEC-1-DB.

The SDF peak outflow calculated for the dam is 40,769 cfs. This value is derived from the 100-year flood, and results in overtopping of the dam, assuming that the lake was originally at the spillway crest elevation.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, utilizing HEC-1 Dam Safety Version Program.

The reservoir stage-storage capacity relationship was computed directly by the conic method, utilizing the HEC-1-DB program. The reservoir surface areas at various elevations were measured by planimeter from a U.S.G.S. Quadrangle topographic map. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based

on the assumption that the dam remains intact during routing. The spillway rating curve is presented in the Hydrologic Computation, Appendix D.

Drawdown calculations indicate that to empty the lake to an elevation of 88.0 NGVD through the four low-level outlets would take 3 hours, assuming no inflow. With a constant inflow of 2 cfs/square mile, drawdown is not possible at all.

b. Experience Data

No records of reservoir stage or spillway discharges are maintained for this site.

c. Visual Observation

The downstream channel is in good condition. It has a wide rock covered bottom and shallow banks. The left bank is a very flat flood plain that is used primarily for grazing of animals. The right bank is mostly wooded. The channel crosses under Rockafellows Mill Road, 300 feet downstream and then under U.S. Route 202, 2,400 feet from the dam. There are three residences immediately downstream on the left above the flood plain.

The side slopes of the reservoir are flat with no signs of instability. River Road parallels the right shore while the left is a flat flood plain.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 6.41 feet. Computations indicate that the dam can pass approximately 4 percent of the 100-year storm without overtopping the dam crest. Since the 100-year storm is the Spillway Design Flood (SDF) for this dam, according to the Recommended Guidelines for Safety Inspection of Dams by the Corps of Engineers, the spillway capacity of the dam is assessed as "inadequate".

SECTION 6

6. STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

At the time of inspection Rockafellows Mills Dam did not exhibit any visible signs of major distress. There was no evidence of tilting, misalignment or movement of the foundation. The downstream face of the spillway is very badly spalled. There is a diagonal crack approximately 60 feet from the left end which appeared tight. At the right end of the dam a 30 foot breach has been repaired with the construction joint being open about one inch. Also in this area the dam has been undermined. At the left wingwall the concrete cap is cracked and has settled in some places. The upstream face of this wingwall has been eroded exposing the rock fill and seepage was observed under the entire length of the wingwall. There was also some cracks and spalling on the top concrete surface of the deck on the right side near the water wheel.

b. Design and Construction Data

No design computations relating to stability were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment.

c. Operating Records

No operating records are available relating to the stability of the dam.

d. Post - Construction Changes

The dam was rebuilt in 1919 after a failure. There were also dam failures in 1930 and 1978, the causes and extent of which were unknown. The only known repair occurred in 1978 when a 30 foot breach at the right end was repaired.

e. Static Stability

A static stability analysis was not performed for Rockafellows Mills Dam because the lack of data on which to base assumptions of material properties of the foundation material might produce misleading results, but based on the findings of the visual inspection, the preliminary assessment of static stability is that it is satisfactory.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist, and based on the findings of the visual inspection, the preliminary assessment of the static and seismic stabilities is that they are satisfactory.

SECTION 7

7. ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

Rockafellows Mills Dam is inadequate because the dam does not have spillway capacity to pass the SDF, 100-year flood, without overtopping. The present spillway capacity of the dam is approximately 4 percent of the 100-year storm.

No definitive statement pertaining to the safety of the dam can be made without acquisition of foundation material engineering properties, but based on the findings of the visual inspection, preliminary assessment of the static stability is that it is satisfactory.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even an approximate computation of the stability of the dam. A preliminary assessment of the dam could be made by visual observation only.

c. Urgency

The remedial measures and recommended actions along with a timetable for their completion are detailed below. All recommended action should be conducted under the supervision of an engineer who is experienced in the design, construction and inspection of dams.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

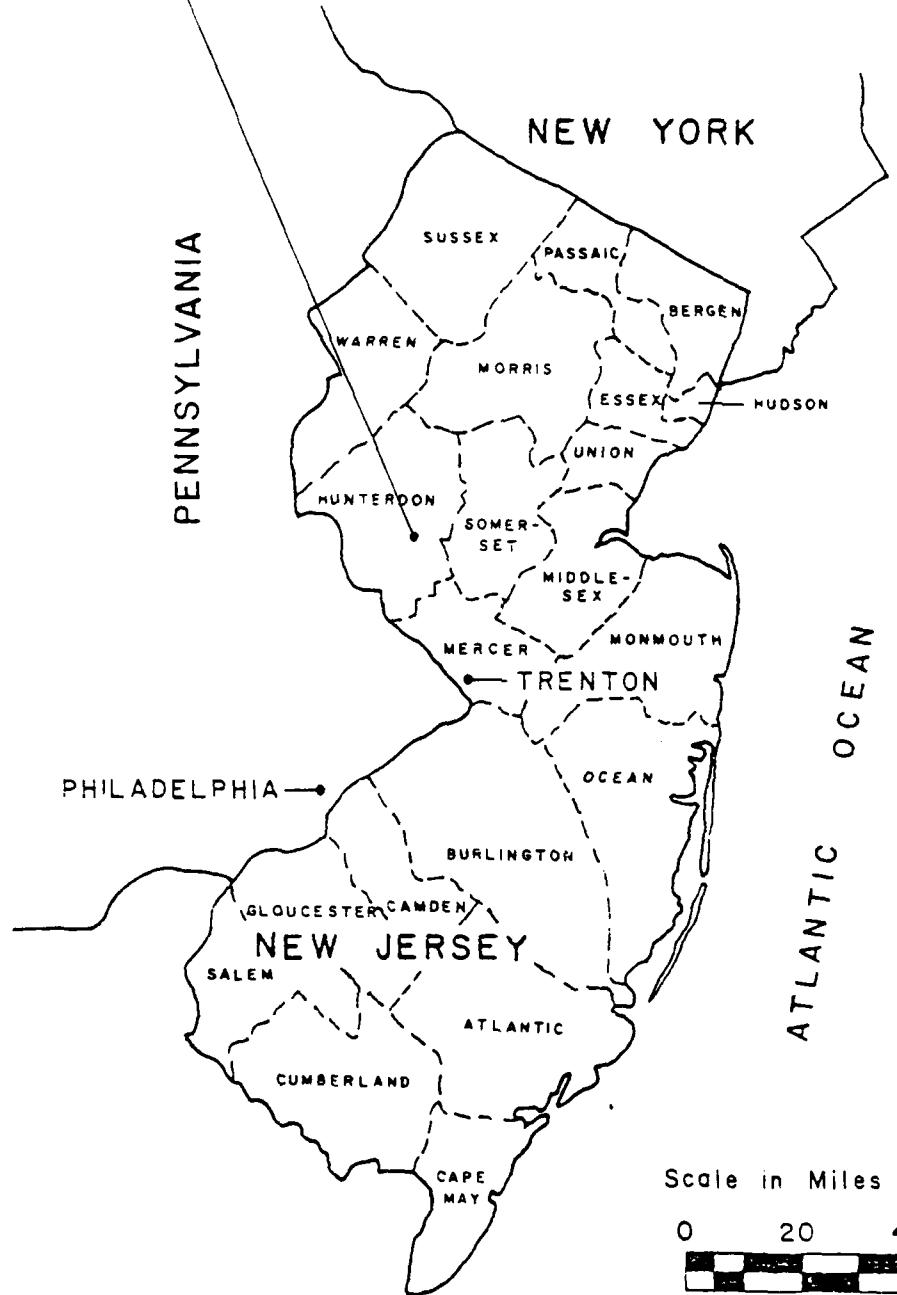
Alternatives for increasing spillway capacity are not required as the hazard potential of the dam is rated as "low".

b. Recommendations

1. Repair all spalled and deteriorated concrete on the downstream face of the spillways within twelve months.
2. Repair the cracked and deteriorated left wingwall within twelve months.
3. Fill in the eroded area of bank at the left wingwall with suitable material within twelve months.

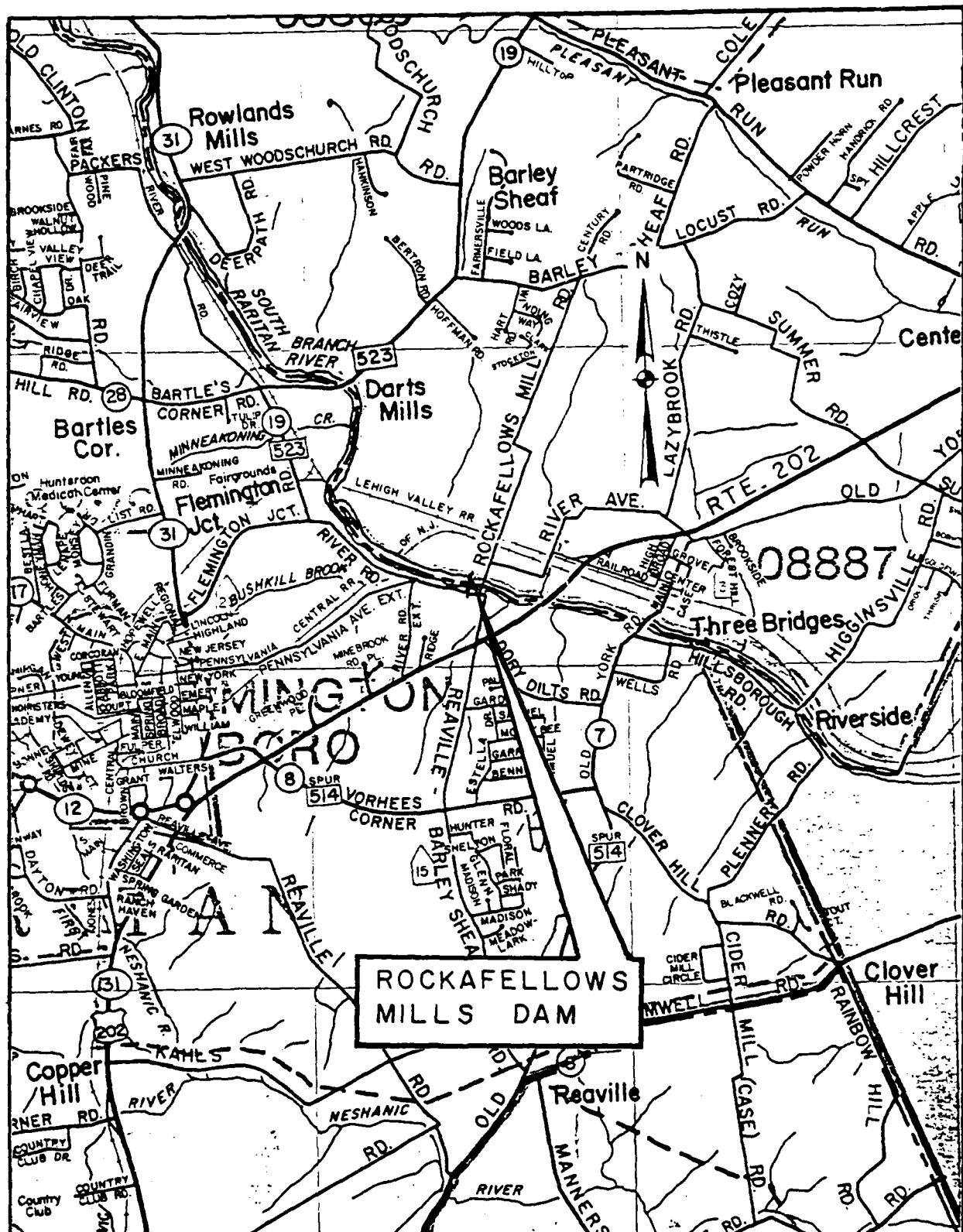
P L A T E S

ROCKAFELLOWS MILLS DAM
RARITAN TOWNSHIP
HUNTERDON COUNTY, N. J.



KEY MAP

PLATE I

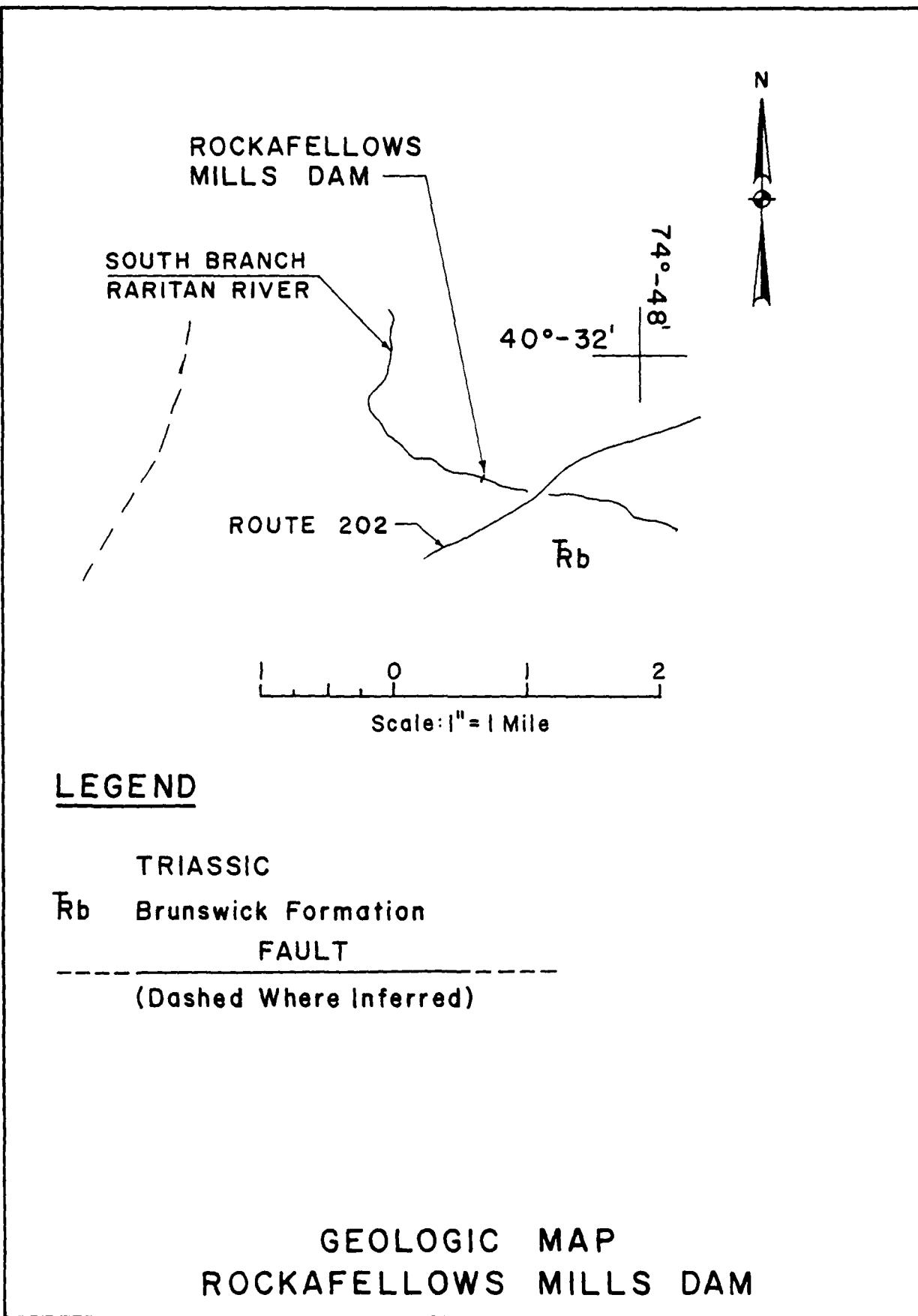


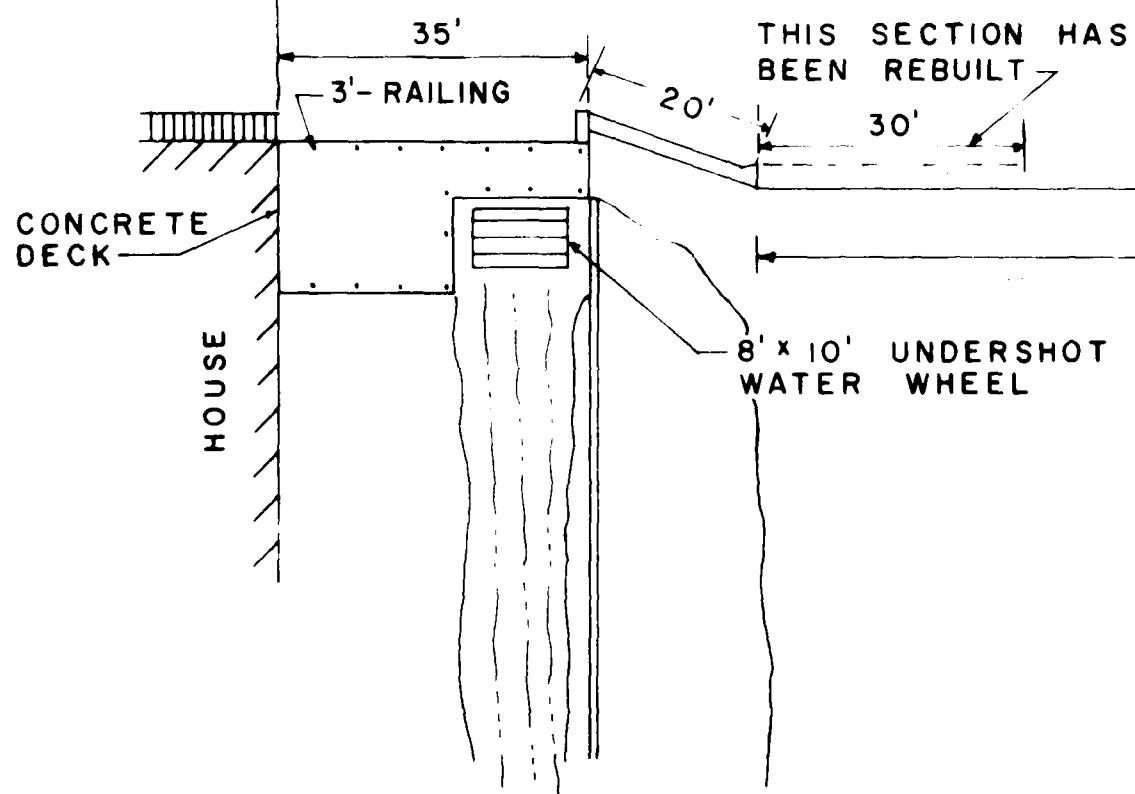
Scale in Miles (Approx.)



VICINITY MAP

PLATE 2





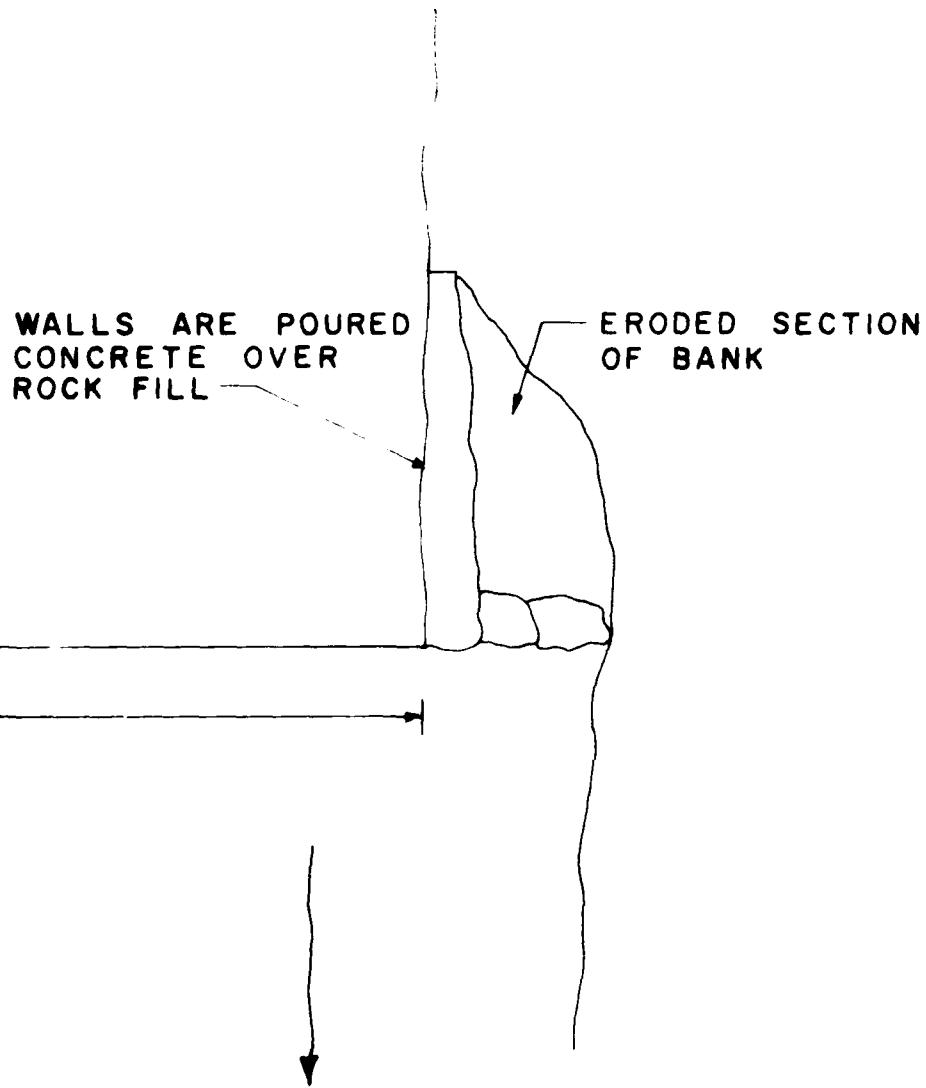


SOUTH BRANCH
RARITAN RIVER

WALLS ARE PO
CONCRETE OVE
ROCK FILL

235'
MAIN SPILLWAY

PLAN
SCALE: 1" = 20'



ROCKAFELLOWS MILLS DAM
RARITAN TWP, HUNTERDON CO., N.J.

SKETCH OF PLAN
PREPARED FROM FIELD NOTES TAKEN
DURING INSPECTION ON MAR. 27, 1981

BY
HARRIS-ECI ASSOCIATES
WOODBRIDGE, N.J.

SCALE AS SHOWN
DATE MAR 1981
SHEET 1 OF 1

APPENDIX A
CHECK LIST - VISUAL OBSERVATIONS
CHECK LIST - ENGINEERING, CONSTRUCTION
MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION
PHASE 1

Name Dam Rockafellows Mills Dam County Hunterdon State New Jersey Coordinators NJ-DEP

Date(s) Inspection March 27, 1981 Weather Cloudy Temperature 45⁰F

Pool Elevation at Time of Inspection 98. NGVD Tailwater at Time of Inspection 91.5 NGVD

Inspection Personnel:

March 27, 1981

Thomas Moroney
Joseph Siriani (Recorder)

OWNER/REPRESENTATIVE

Jacob Beitz
R.D. 7 Box 679
Flemington, NJ

CONCRETE SPILLWAY

VISUAL EXAMINATION OF SEEPAGE OR LEAKAGE	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
Seepage under entire length of left wingwall. Seepage flows around end section of wingwall into the downstream channel.	See below.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Concrete cap of L shaped left wingwall is badly cracked and settled. Upstream face has been eroded completely by seepage exposing the rock fill. Left side of wingwall parallel to river has been eroded and deteriorated from seepage. Large section of bank left of wingwall is eroded.	Replace & repair cracked concrete and fill in eroded section of bank with suitable material.
DRAINS	None	
WATER PASSAGES	None	
FOUNDATIONS	Unknown	

CONCRETE SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Downstream face of main and auxiliary spillways are very badly spalled. The bottom of the main spillway at the right end has been undermined. A 30 foot section of the main spillway had been breached and was replaced.	Repair spalled concrete.
STRUCTURAL CRACKING	There is a diagonal crack approximately 60 feet from the left end. The crack appeared tight.	
VERTICAL & HORIZONTAL ALIGNMENT	Good.	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	The joint should be sealed with joint sealer.	

OUTLET WORKS

VISUAL EXAMINATION OF CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
N/A		Repair cracks and spalled concrete.
INTAKE STRUCTURE	The intake structure is a 10 ft. by 35 ft. concrete chamber. The flow to the water wheel was controlled by four 20-inch valves. There are some cracks and spalling on the top concrete surface.	
OUTLET STRUCTURE	The outlet structure consists of an 8 foot wide by 10 foot high undershot water wheel. The wheel is no longer operative. Two of the valves are shut, the other two are partially opened. None of the valves are operational.	The flow from the wheel discharges into a narrow steep channel that flows under Rockafellows Mill Road through a 40" x 65" C.M.P. 300 feet from the dam and then into the river approximately 400 feet downstream of the road.
OUTLET FACILITIES	None	4

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONCRETE WEIR		
See concrete spillway sheets.		
APPROACH CHANNEL		
	South Branch of Raritan River is approach channel.	
DISCHARGE CHANNEL		
	South Branch of Raritan River is discharge channel. Channel bottom at base of spillway has scoured and undermined with depth of water over 6 feet.	
BRIDGE AND PIERS		
	None.	

INSTRUMENTATION

VISUAL EXAMINATION OF MONUMENTATION/SURVEYS	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
OBSERVATION WELLS		
	None.	
WEIRS		
	None.	
PIEZOMETERS		
	None.	
OTHER		
	None.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS		
SLOPES	The banks of the river are about 2 feet high and very flat. The right bank looking upstream is pastures with some trees. River Road parallels the left bank.			
SEDIMENTATION	Sedimentation was noticed along the river bottom and top of spillway.			

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
The downstream channel is very wide and rocky with a layer of sedimentation. There is a small island in the middle of the channel.		
SLOPES The slopes are very flat and about 2 feet high. The left side is pasture land, the right is lightly wooded.		
APPROXIMATE NUMBER OF HOMES AND POPULATION The channel crosses under Rockafellows Mill Road bridge through a 10 foot by 300 foot opening, approximately 300 feet downstream and under Route 202 approximately 2,400 feet downstream. There are three buildings immediately downstream off to the left and above the flood plain.		

CHECK LIST
 ENGINEERING DATA
 DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
REGIONAL VICINITY MAP	Available - Hunterdon County Map and U.S.G.S. Quadrangle Sheet for Flemington, New Jersey.
CONSTRUCTION HISTORY	Not available.
TYPIICAL SECTIONS OF DAM	Sketch available in files at NJ Department of Environmental Protection (NJ-DEP), 1474 Prospect Street, P.O. Box CN-029, Trenton, NJ 08626
HYDROLOGIC/HYDRAULIC DATA	None available.
OUTLETS - PLAN	None available.
- DETAILS	None available.
- CONSTRAINTS	None
- DISCHARGE RATINGS	Not available.
RAINFALL / RESERVOIR RECORDS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
GEOLOGY REPORTS	None available.
DESIGN REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEE PAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Unknown
SPILLWAY PLAN - SECTIONS - DETAILS	None available.

CHECK LIST
 ENGINEERING DATA
 DESIGN, CONSTRUCTION, OPERATION
 (continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	Not kept.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION - REPORTS	Dam failed in 1919, 1930 and 1978. Causes unknown.
MAINTENANCE OPERATION RECORDS	None known to exist.

APPENDIX B

PHOTOGRAPHS

(Taken on March 27, 1981)

ROCKAFELLOWS MILLS DAM



Photo 1 - View of dam looking towards the left end. Dry area of spillway is section repaired in 1978.

ROCKAFELLOWS MILLS DAM



Photo 2 - View of spalled and deteriorated downstream face of auxiliary spillway.



Photo 3 - View of downstream face of spillway. Section of spillway from diagonal crack to the left is the repaired portion of the spillway.

ROCKAFELLOWS MILLS DAM



Photo 4 - View of downstream face of the wingwall at the left end of the dam.



Photo 5 - View of upstream face and left side of L shaped wingwall at left end of dam. There is seepage along the entire left side of portion parallel to river.

ROCKAFELLOWS MILLS DAM



Photo 6 - View upstream of auxiliary spillway and water wheel structure.



Photo 7 - View of water wheel from downstream.

ROCKAFELLOWS MILLS DAM



Photo 8 - View of dam and upstream from downstream channel.



Photo 9 - View of downstream channel from spillway.

APPENDIX C

SUMMARY OF ENGINEERING DATA

1.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: ROCKAFELLOWS MILLS DAM

Drainage Area Characteristics: 174 square miles

Elevation Top Normal Pool (Storage Capacity): 98.0 NGVD (27 acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: 106.21 NGVD (SDF pool: 275 acre-feet)

Elevation Top Dam: 102.0 NGVD (50 acre-feet @ 99.8 NGVD*)

SPILLWAY CREST: Main: 98.0 NGVD

a. Elevation Auxiliary: 99.8 NGVD

b. Type Broad crested

c. Width 1.5 feet

d. Length Main: 235 feet; Auxiliary: 20 feet

e. Location Spillover Entire length of main spillway

f. No. and Type of Gates None

OUTLET WORKS:

a. Type 4 - 20-inch pipes

b. Location Right side of dam at water wheel structure.

c. Entrance Inverts Unknown

d. Exit Inverts Unknown

e. Emergency Draindown Facilities 4 - 20-inch valves

HYDROMETEOROLOGICAL GAGES:

a. Type None

b. Location None

c. Records None

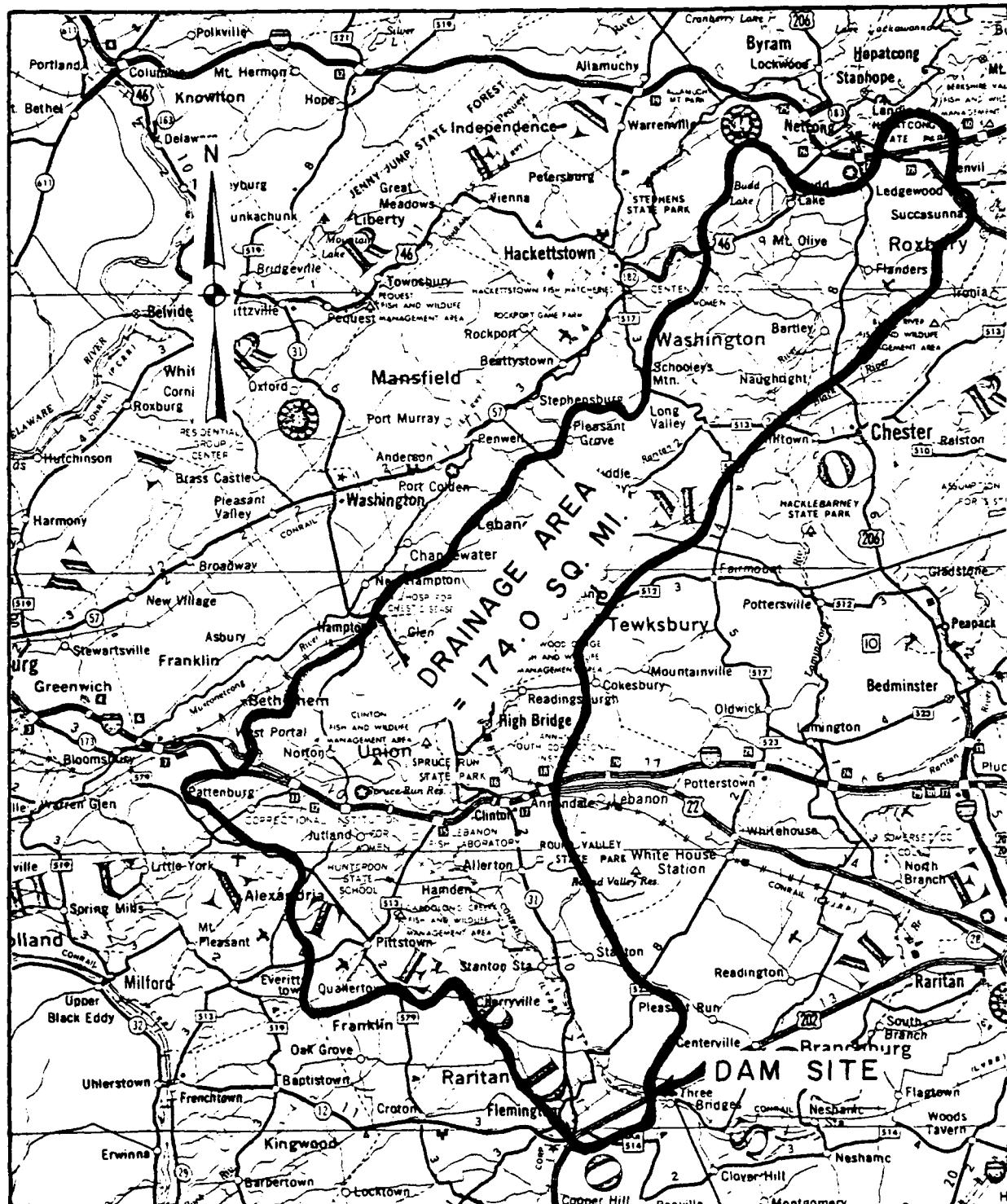
MAXIMUM NON-DAMAGING DISCHARGE: 1,707 cfs at elevation 99.8 NGVD.*

* Elevation at which river overflows left bank onto a wide flood plain.

APPENDIX D

HYDROLOGIC COMPUTATIONS

PLATE I, APPENDIX D



A horizontal number line with tick marks every 1 unit. The line is labeled with the numbers -4, 0, 4, and 8. The tick marks are evenly spaced between these labeled points.

Scale: 1 = 4 Miles

ROCKAFELLOWS MILLS DAM

DRAINAGE BASIN

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT: N. J. Dam Inspection
Rockefeller Hills Dam
COMPUTED BY: S. B. CHECKED BY:

1 OF
JOB NO. 16-1176-51
DATE: DEC. 1981

Area of Lake at normal pool level
= 8.2 AC

Height of the Dam = 14 FT

Small Dam, -

Hazard Classification = Low

S.D.F = 100 year. Storm

Hydrologic analysis

D.A = 174 sq. miles

Inflow Hydrograph at reservoir was
determined using HEC 1 DB program.
Inflow routed through reservoir

Reservoir Stage area relationship

Elevation	Area in Acres
88	0
98	8.2
100	12.9
120	339.7

PRO[®] Harris, Inc.
CONSULTING ENGINEERS

SUBJECT: N.J. Dam Inspection:
R.R. Rafellos Mills Dam
COMPUTED BY: 22 CHECKED BY: 22

SHEET NO. 2 OF _____
JOB NO. 19-1176-01
DATE: June 1981

Precipitation Frequency Values (inches) of 100 yr. for

60 min. 3.05 Ref- NWS-Hyds - 35-

2 hr. 3.88

3 hr 4.35

4 hr. 4.73

5 hr. 4.98

6 hr. 5.20

Ref NWS-TP Nr. 40

PRC Harris, Inc.

CONSULTING ENGINEERS

SUBJECT..... N.J. Dam Inspection
Rockafellows Dam
COMPUTED BY..... S.B. CHECKED BY.....

3 OF
JOB NO. 10-1176-01
DATE.....

100 year Rainfall distribution (1 hr duration)

Time (hr)	Total depth (inch)	4 d inch.
1	3.05	3.05
2	3.82	.83
3	4.35	.47
4	4.73	.38
5	4.98	.25
6	5.20	.22

Rainfall design arrangement

.25, .83, 3.05, .47, .38, .22

3 Hour Unit Hydrograph

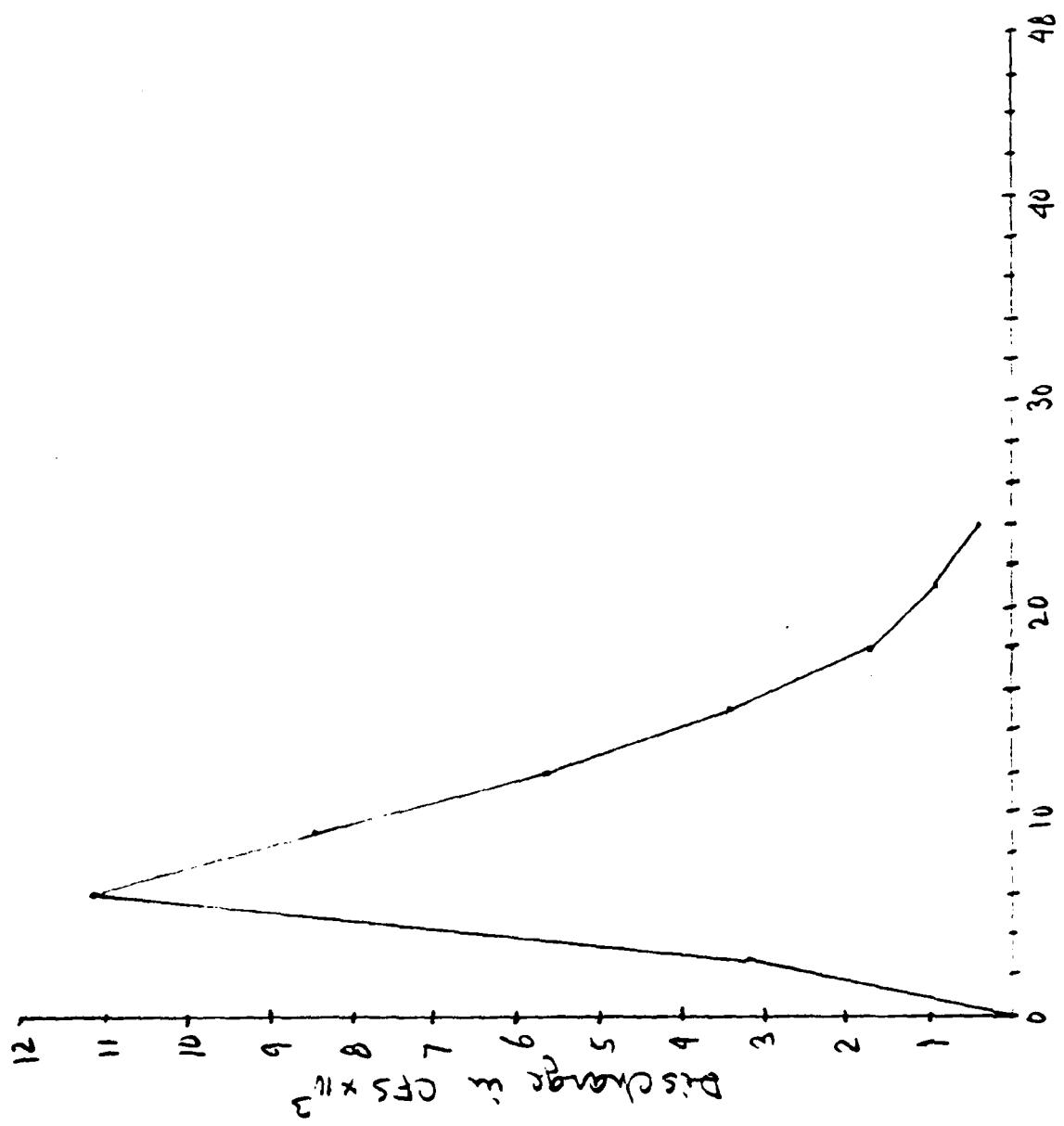
U.H.G. Darts Mill Dam (D.A. 165 sq miles) is available for use. The same U.H.G. was used for Rockafellows Mills Dam with adjustments of drainage area (174 sq miles)

Hour	3 Hr U.H.G Darts Mill	3 Hr U.H.G (Rockafellows)
0	0	0
3	2800	3,114
6	10500	11,073
9	8000	8,436
12	5300	5,589
15	3300	3,480
18	1600	1,607
21	900	949
24	700	738
27	500	527
30	400	422
33	300	316
36	250	264
39	200	211
42	150	158
45	100	105
48	50	53

PRC Harris, Inc.
CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection
Rockfalls Mills Dam
COMPUTED BY S.B. CHECKED BY

5
SHEET NO. 5 OF
JOB NO. 10-1176-51
DATE May 1, 1981



PRC Harris, Inc.

CONSULTING ENGINEERS

SUBJECT: N.J. Dam Inspection
Rockefeller Hills Dam

COMPUTED BY: S.B. CHECKED BY:

SHEET NO. 6 OF 10
JOB NO. 1b-1176-97
DATE: May 1, 1981

Unit H.G. is tabulated at 1 hr. interval

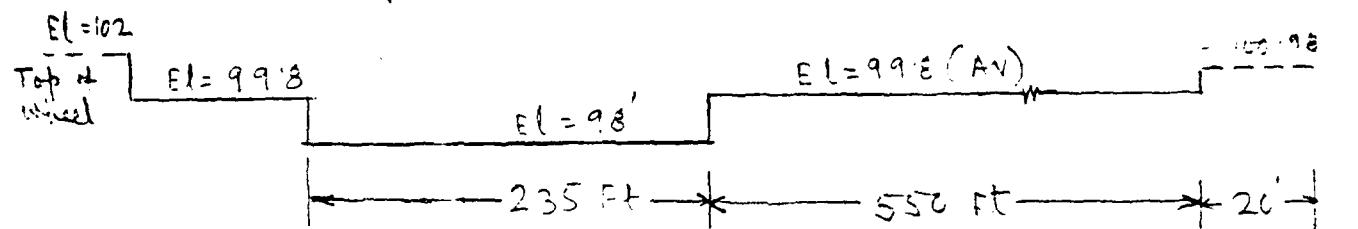
Time (hrs)	3 HR UHG ①	S-Curve addition ③	S-Curve ②+③ ④	Lagged S-Curve ⑤	④-⑤ ⑥	Adj. sted ⑦	1 HR UHG ⑦ x 3
0	0		0	0	0	0	0
1	1038		1038	0	1038	519	1557
2	2076		2076	1538	1038	1038	3114
3	3114	0	3114	1538	1038	1557	4671
4	6000	1038	7038	3924	3924	3924	11,772
5	8500	2076	10576	3538	3538	3611	15,833
6	11073	3114	14187	3611	3538	3538	15,614
7	10194	7038	17232	3045	3045	3045	7,135
8	9315	10576	19891	2659	2659	2732	8,196
9	8436	14187	22623	2732	2732	2659	7,977
10	7487	17232	24719	2096	2096	2096	6253
11	6538	19891	26429	1710	1710	1783	5349
12	5589	22623	28212	1783	1783	1710	5130
13	4886	24719	29605	1393	1393	1393	4179
14	4183	26429	30612	1007	1007	1080	3240
15	3480	28212	31692	1580	1580	1007	3021
16	2883	29605	32488	796	796	796	2388
17	2285	30612	32897	409	409	550	1650
18	1687	31692	33379	482	482	482	1446
19	1441	32488	33929	550	550	409	1227
20	1195	32897	34092	163	163	479	1437
21	949	33379	34328	236	236	236	705
22	878	33929	34807	479	479	166	496
23	808	34092	34900	93	93	163	469
24	738	34328	35066	166	166	93	277
		34807					
		34900					
		35066					

Coord.
not
calculated

Note: The UHG ordinate for later part is insignificant
in determination of peak flow which will be
before 24 hrs. Area under the UHG is much less than 1"

Rating Curve:-

Schematic Layout of Dam and Spillway



$$\text{Spillway} = 235 \text{ ft} \quad C = 3.0$$

$$\text{Dam} \approx 570 \text{ ft} \quad C = 2.6$$

Dam will be overtopped before it reaches the top.
wheel

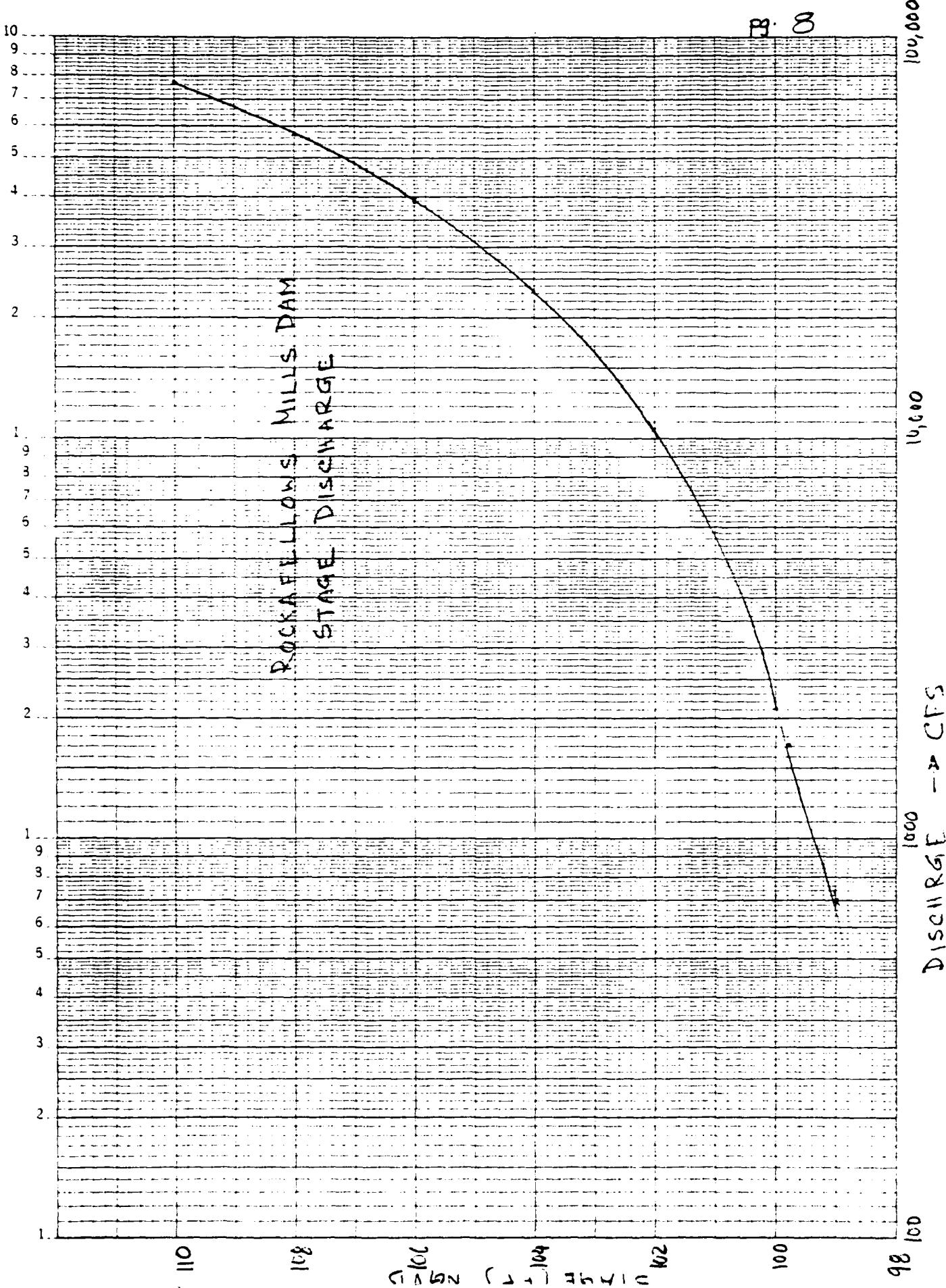
$$Q_{\text{SPILL}} = 3 \times 235 \text{ ft}^3/\text{s} = 705 \text{ ft}^3/\text{s}$$

$$Q_{\text{DAM}} = 2.6 \times 570 \text{ ft}^3/\text{s} = 1482 \text{ ft}^3/\text{s}$$

W.S. EL	Q _s	Q _s 1.5	HD	HD	Q _d 1.5	Q _d total
9.8	0	-			0	0
99	1	707			707	707
99.8	1.8	1717	0		1717	1717
100	2	2,000	1.2	133	2,133	2,133
102	4	5,656	2.2	4,336	10,492	5536
104	6	10,391	4.2	12,756	23,147	23,147
106	8	15,226	6.2	22,679	38,877	38,877
108	10	22,357	8.2	34,797	57,156	57,156
110	12	29,389	10.2	46,275	77,667	77,667

K-E SEMI-LOGARITHMIC CYCLES & DIVISIONS
KEUFFEL & ESSEN CO. MADE IN U.S.A.

46 5490



DRAWDOWN COMPUTATION

Normal elevation to start = 98.0

$$\text{Inflow} = \frac{2 \text{ cfs}}{\text{mi}^2} \times 174 = 348 \text{ CFS}$$

4 Nos 20" dia Pipe
A = 8.73 sq. ft

Tailwater is assumed 88.0' for
the computation purpose.

$$Q = CA \sqrt{2gH} = .62 \times 8.73 \times 8 \sqrt{H}$$

$$= 43.3 \sqrt{H}$$

At max. head outflow = 136 cfs.

∴ Drawdown is not possible with constant
inflow even at 1 cfs / mi²

$$A_2 = \left(\frac{h_2}{h_1}\right)^2 A_1 = \left(\frac{h_2}{10}\right)^2 \times 8.2 = 108.2 \frac{h_2^2}{100} \quad (A_1 = 8.2 \text{ ft}^2, h_1 = 10 \text{ ft})$$

$$\text{Drawdown time} = \frac{\text{Vol. in AF} \times 43560}{Q \times 3600} = 12.1 \frac{\text{Vol}}{\text{Q}} \text{ Hrs.}$$

Res. EL. (ft)	Area. (Ac)	Avg. Area (Ac)	Vol (AF)	Avg. Head (ft)	Q 43.3 \sqrt{H}	Drawdown Time Vol \times 12.1 / Q (Hrs)	Cum Time (Hrs)
------------------	---------------	-------------------	-------------	-------------------	--------------------	--	----------------------

98	8.2	6.7	13.4	9	129.9	1.25	1.25
96	5.2	4.1	8.2	7	114.6	.87	2.12
94	3.0	2.15	4.3	5	96.8	.54	2.66
92	1.3	.815	1.63	3	75.0	.26	2.92
90	.33	.165	.33	1	43.3	.09	3.01
88	0						

Time of Drawdown without inflow = 3.01 hrs \approx 3 hrs

Reaction Temperature (°C)	Reaction Time (h)	Yield (%)
100	10	95
100	20	98
100	30	99
100	40	99.5
100	50	99.8
100	60	99.9
100	70	99.95
100	80	99.98
100	90	99.99
100	100	99.995
100	120	99.998
100	140	99.999
100	160	99.9995
100	180	99.9998
100	200	99.9999
100	220	99.99995
100	240	99.99998
100	260	99.99999
100	280	99.999995
100	300	99.999998
100	320	99.999999
100	340	99.9999995
100	360	99.9999998
100	380	99.9999999
100	400	99.99999995
100	420	99.99999998
100	440	99.99999999
100	460	99.999999995
100	480	99.999999998
100	500	99.999999999
100	520	99.9999999995
100	540	99.9999999998
100	560	99.9999999999
100	580	99.99999999995
100	600	99.99999999998
100	620	99.99999999999
100	640	99.999999999995
100	660	99.999999999998
100	680	99.999999999999
100	700	99.9999999999995
100	720	99.9999999999998
100	740	99.9999999999999
100	760	99.99999999999995
100	780	99.99999999999998
100	800	99.99999999999999
100	820	99.999999999999995
100	840	99.999999999999998
100	860	99.999999999999999
100	880	99.9999999999999995
100	900	99.9999999999999998
100	920	99.9999999999999999
100	940	99.99999999999999995
100	960	99.99999999999999998
100	980	99.99999999999999999
100	1000	99.999999999999999995

THE PRACTICAL USE OF THE BIBLICAL HISTORIES IN THE TEACHING OF THE BIBLE.

1. *Die Wirkung der Erziehung auf die Entwicklung des Kindes* (1922).

but I expect some of the differences will be reflected in the final product.

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